Remarks

The following remarks are submitted in response to the Office Action mailed May 9, 2001. Claims 2-22 and 33-43 remain pending in the application. Claims 1 and 23-32 have been canceled without prejudice, and claims 2, 33, 36, 37 and 42 have been amended. Reconsideration, reexamination and allowance of all pending claims are respectfully requested.

On page 2 of the Office Action, the Examiner rejected claims 2, 3, 27, 28-35 and 42 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. With regard to claim 2, the Examiner states that the term "partially" is a relative term that renders the claim indefinite.

Applicants respectfully disagree. MPEP §2173.05(b) states:

> The fact that claim language, including terms of degree, may not be precise, does not automatically render the claim indefinite under 35 U.S.C. 112, second paragraph. *Seattle Box Co., v. Industrial Crating & Packing, Inc.*, 731 F.2d 818, 221 USPQ 568 (Fed. Cir. 1984). Acceptability of the claim language depends on whether one of ordinary skill in the art would understand what is claimed, in light of the specification.

Clearly, one skilled in the art would recognize that the reflectivity of a layer may range from 0% to 100%, and that the electrical conductivity of a layer may range from 0% to 100%. Claim 2 recites that the first contact layer of the reflector means is "at least partially reflective" and "at least partially" electrically conductive. One skilled in the art would clearly understand that what is claimed is a first contact layer that is more than 0% reflective and more than 0% conductive. Thus, the scope of the claim can be readily determined. In view thereof, Applicants must respectfully disagree with the Examiner that claims 2-3 are indefinite under 35 U.S.C. §112, second paragraph.

On page 2 of the Office Action, the Examiner rejected claim 27, as well as claims 28-35

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which depend from claim 27, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. The Examiner states that the term "larger" as used in claim 27 is not defined by the claim. As detailed further below, claims 27-32 have been cancelled without prejudice. Claim 33 has been amended to recite all of the limitations of claims 23 and 32. Because claims 33-35 do not include the term "larger", as recited in claim 27, Applicants believe that remaining claims 33-35 now fully comply with 35 U.S.C. §112, second paragraph.

On page 3 of the Office Action the Examiner rejected claims 42-43 as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. The Examiner objected to the phrase "said column contact layers extending adjacent at least a portion of selected side walls to help reduce optical cross talk between the radiation sources." In response, Applicants have amended claim 42 to recite:

> 42. An array of visible light emitting devices according to claim 41, wherein selected radiation sources of the array of radiation sources have side walls that face adjacent radiation sources, said column contact layers extending adjacent at least a portion of [selected] said side walls of the selected radiation sources to help reduce optical cross talk between the radiation sources.

This amendment clarifies the claim, by stating more clearly that the column contact layers extend adjacent to at least a portion of the side walls which exist on selected radiation sources of the array. With this amendment, Applicants believe claim 42, and dependent claim 43, fully comply with 35 U.S.C. §112 second paragraph.

On page 3 of the Office Action, the Examiner rejected claims 1, 4-6, 18, 20, and 23-25 under 35 U.S.C. §102(e) as being anticipated by Vriens et al. (U.S. Patent No. 5,813,753). The Vriens et al. disclosure appears to suggest an LED stack placed on the bottom side of a rounded channel

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(taking a two dimensional view) filled with a phosphor/epoxy blend (see Figures 2-4 of Vriens et al.). On the opposing, top side of the rounded channel is a glass plate 26, the glass plate being used "to prevent UV/blue light which is not absorbed by the phosphor grains from exiting into air." (Vriens et al., column 3, lines 37-39). In Figure 3, Vriens et al. include a long wave pass filter (LWP filter) 37 between the glass plate 36 and the phosphor/epoxy layer 34,35. Vriens et al. explains:

> The functions of the LWP filter are: (1) to reflect UV/blue light back to the phosphor and (2) to transmit visible light emitted by the phosphor. This ensures a better absorption of the UV/blue by the phosphor and also makes it possible to reduce the phosphor grain density somewhat. This in turn enhances the transmission of the visible light.

(Vriens et al., column 5, lines 6-11). In Figure 4, Vriens et al. includes a short-wave-pass filter (SWP filter) 47 placed directly on top of the LED stack 41. The SWP filter functions "to reflect light of too long wavelength" and "to reflect part of the light of the wanted wavelengths". (Vriens et al., column 5, lines 51-53). The SWP filter causes "a more narrow angular distribution with up to a factor of 2 gain in light intensity in the forward direction, and furthermore a more saturated (i.e., more pure) color." (Vriens et al., column 5, lines 61-63).

Applicants have cancelled claim 1 without prejudice and incorporated all elements thereof into claim 2. Claim 2, as amended, adds the following to claim 1:

> wherein said reflector means comprises a first contact layer positioned over at least part of the phosphor layer, the first contact layer being at least partially reflective and at least partially electrically conductive, said first contact layer being electrically connected to the first contact region.

Vriens et al. do not appear to suggest a reflector that also functions as a contact layer. The Examiner appears to recognize this, as claim 2 was not rejected under Vriens et al. In view thereof, Applicants believe that the amended claim 2, and dependent claim 3, are now clearly patentable over Vriens et

al. The Examiner's rejection of claim 2 under Singer et al. is discussed below.

With respect to claim 4, on page 4 of the Office Action, the Examiner states that "at least some of the phosphor layer of Figure 5 is between the LED stack and some of the glass plate of" Vriens et al. Claim 4 recites:

> 4. A visible light emitting device comprising:
> a transparent substrate;
> a phosphor layer including one or more excitable, visible light-emitting phosphors;
> a radiation source positioned between the transparent substrate and the phosphor layer for providing a radiation to excite visible light emission from the phosphor layer, the radiation source having a first contact region and a second contact region;
> a first contact layer provided over at least part of the phosphor layer and reflecting at least some of the radiation that travels through the phosphor layer back into the phosphor layer, the first contact layer being electrically connected to the first contact region; and
> a second contact layer being electrically connected to the second contact region.

Claim 4 is similar to allowed claim 21. The claim recites a "radiation source positioned between the transparent substrate and the phosphor layer." In Figure 2 of Vriens et al., the LED stack 21 cannot be said to be "between" the phosphor layer 24 and the glass plate 26, nor in Figure 3 can the LED stack 31 be said to be between the glass plate 36 and the phosphor layer 34. Again, in Figure 4, the LED stack 41 cannot be described as between the phosphor layer 44 and the glass plate 46. Finally, in Figure 5, the LED stack cannot be said to be "between" the phosphor layer 54 and the glass plate 56. In view thereof, Applicants believe that independent claim 4, and dependent claims 5-20, are clearly patentable over Vriens et al.

Claim 23 and 32 have been incorporated into claim 33, and claims 23-32 have been canceled, without prejudice.

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With respect to claim 33, on page 7 of the Office Action, the Examiner stated "wherein the first contact layer (ohmic contact 6, Figure 1b) is provided over at least part of the top wall of the phosphor layer." After carefully reviewing the cited reference, Applicants must respectfully disagree.

Claim 33 has been amended and rewritten in independent form to include the limitations of base claims 23 and 32. As amended, claim 33 recites:

> 33. (Amended) A light emitting device [according to claim 32, further] comprising:
>
> a radiation source having a first contact region and a second contact region for providing radiation, said radiation source having a top surface and one or more side walls;
>
> a phosphor layer provided adjacent to at least a portion of the one or more side walls of the radiation source, the phosphor layer including one or more excitable, light-emitting phosphors that produce a light emission when excited by the radiation, the phosphor layer extending laterally away from the side walls of the radiation source a selected distance, at least in one direction, to define a top wall and one or more side walls;
>
> a first contact layer, the first contact layer being provided over at least part of the top wall of the phosphor layer.

Of particular relevance to the Vriens et al. disclosure, claim 33 recites a "contact layer being provided over at least part of the top wall of the phosphor layer." The ohmic contact 6 in Figure 1b of Vriens et al. is not provided over at least part of the top wall of the phosphor layer. In Figure 1b of Vriens et al., the ohmic contact 6 is directly on the p-type layer of the LED. There is no suggestion of how a contact could or would be placed so that it would be provided over at least part of a top wall of the phosphor layer; indeed, other than the prior art description made in Vriens et al. of Figures 1a and 1b, there does not appear to be any other references or descriptions of possible placements of the ohmic contact, in particular with respect to the phosphor layer. Therefore,

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Applicants believe claim 33, as amended, and dependent claims 34-39, are clearly patentable over Vriens et al.

On page 7 of the Office Action, the Examiner rejected claims 1-3 under 35 U.S.C. §102(e) as being anticipated by Singer et al. (U.S. Patent No. 5,813,752).

Singer et al. appears to suggest a UV/Blue LED phosphor device with short wave pass (SWP) and long wave pass (LWP) and Peroit filters. Referring to Figure 1 of Singer et al., a LED 16 is placed on a mirror 15 and beneath a phosphor-laden layer 32, which is separated from the LED by a SWP layer 30. Adding Figure 2, Singer et al. appear to suggest another SWP filter 42 placed atop the phosphor layer 40, which is in turn on a SWP filter 38, placed on an LED 36.

The Examiner states on page 7 of the Office Action that Singer et al. show "reflector means (15 mirror 15, 30 SWP layer or 42 reflector, Figure 2) provided adjacent a second one of the two opposing sides of the phosphor layer." After carefully reviewing the cited reference, Applicants must respectfully disagree.

Applicants have amended claim 2 to include all of the limitations of original claim 1. Claim 2, as amended, recites:

> 2. (Amended) A light emitting device [according to claim 1,] comprising:
> a phosphor layer having two opposing sides including one or more excitable, light-emitting phosphors;
> a radiation source positioned adjacent a first one of the two opposing sides of the phosphor layer for providing a radiation to excite a light emission from the phosphor layer, the radiation source having a first contact region and a second contact region;
> reflector means provided adjacent a second one of the two opposing sides of the phosphor layer for reflecting at least some of the radiation and light emission that exits from the phosphor layer back into the phosphor layer; and
> wherein said reflector means comprises a first contact layer positioned over at least part of the phosphor layer, the first contact layer being at least partially reflective and at least partially electrically conductive, said first contact layer being electrically connected to the first contact region.

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As recited in amended claim 2, the reflector means comprises "a first contact layer positioned over at least part of the phosphor layer, the first contact layer being at least partially reflective and at least partially electrically conductive, said first contact layer being electrically connected to the first contact region." Nothing in Singer et al. suggests that either contact 14 or 26 also are a reflector. Indeed, Singer et al. include separate reflectors, which the Examiner identified (mirror 15, SWP layers 30, SWP layer 42 in Figure 2). Since claim 2 recites that the reflector means itself includes the first contact layer, and no part of Singer et al. suggests reflector means that includes a first contact layer positioned over at least part of the phosphor layer, Applicants believe amended claim 2, and dependent claim 3, are clearly patentable over Singer et al.

On page 8 of the Office Action, the Examiner rejected claims 17, 38 and 39 under 35 U.S.C. §103(a) as being unpatentable over Vriens et al. (U.S. Patent No. 5,813,753) in view of Razeghi (U.S. Patent No. 5,834,331). Claim 17 is dependent from claim 4. Thus, for the same reasons given above with respect to claim 4, Applicants believe dependent claim 17 is clearly patentable over Vriens et al., in view of Razeghi. Likewise, claims 38 and 39 are dependent from claim 33. Thus, for the same reasons given above with respect to claim 33, Applicants believe claims 38 and 39 are clearly patentable over Vriens et al. in view of Razeghi.

On page 9 of the Office Action, the Examiner rejected claim 19 under 35 U.S.C. §103(a) as being unpatentable over Vriens et al. (U.S. Patent No. 5,813,753) in view of Chai (U.S. Patent No. 5,625,202). Claim 19 is dependent from claim 18, which is dependent from claim 4. Thus, for the same reasons given above with respect to claim 4, Applicants believe dependent claim 19 is clearly patentable over Vriens et al. in view of Chai.

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On page 9 of the Office Action, the Examiner states that claims 7-16 contained allowable subject matter, and were only objected to as being dependent upon a rejected base claim. As discussed above, Applicants believe independent claim 4 is patentable, from which claims 7-16 either directly or indirectly depend. Therefore, Applicants believe claims 7-16 are now in condition for allowance.

On page 9 of the Office Action, the Examiner stated that claims 36 and 37 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicants have amended claims 36 and 37 to include the limitations of base claim 23, but the limitations of many of the intervening claims were believed to be unnecessary. In view thereof, Applicants believe claims 36 and 37 are now in condition for allowance.

On page 10 of the Office Action, the Examiner allowed claims 21, 22, 40 and 41.

For the reasons set forth above, Applicants believe that all pending claims are now in condition for allowance. Reexamination and reconsideration are respectfully requested. Issuance of a Notice of Allowance is also requested. If a telephone conference might be of assistance, please contact the undersigned attorney at (612) 677-9050.

Respectfully submitted,

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By their attorney,

Date August 8, 2001

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Version with Markings to Show Changes Made

In the Specification

The paragraph beginning at page 8, line 8, has been replaced with the following rewritten paragraph:

--Each of the radiation sources 62A, 62B, and 62C has a first contact region and a second contact region. A number of row contact layers 64A, 64B, and 64C are provided, wherein each row contact layer electrically connects the first contact regions 65A and 65B of the radiation sources that are associated with a corresponding row in the array. Likewise, a number of column contact layers 66A, 66B, and 66C are provided, wherein each column contact layer 66A, 66B, and 66C is provided over at least part of the phosphor segments 60A, 60B, and 60C of the radiation sources that are associated with a corresponding column. The column contact layers 66A, 66B, and 66C also electrically connect the first contact regions 62A and 62B [68A and 68B] of each radiation source that is associated with a corresponding column. As indicated above, it is contemplated that the column contact layers 66A, 66B, and 66C are reflective to reflect at least some of the UV radiation and/or visible light rays that exit from the corresponding phosphor segments 60A, 60B, and 60C, back into the phosphor segments 60A, 60B, and 60C.--

In the Claims

Claims 1 and 23-32 have been cancelled without prejudice.

Please amend the claims as follows:

2. (Amended) A light emitting device [according to claim 1,] comprising:

a phosphor layer having two opposing sides including one or more excitable, light-emitting phosphors;

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a radiation source positioned adjacent a first one of the two opposing sides of the phosphor layer for providing a radiation to excite a light emission from the phosphor layer, the radiation source having a first contact region and a second contact region;

reflector means provided adjacent a second one of the two opposing sides of the phosphor layer for reflecting at least some of the radiation and light emission that exits from the phosphor layer back into the phosphor layer; and

wherein said reflector means comprises a first contact layer positioned over at least part of the phosphor layer, the first contact layer being at least partially reflective and at least partially electrically conductive, said first contact layer being electrically connected to the first contact region.

33. (Amended) A light emitting device [according to claim 32, further] comprising:

a radiation source having a first contact region and a second contact region for providing radiation, said radiation source having a top surface and one or more side walls;

a phosphor layer provided adjacent to at least a portion of the one or more side walls of the radiation source, the phosphor layer including one or more excitable, light-emitting phosphors that produce a light emission when excited by the radiation, the phosphor layer extending laterally away from the side walls of the radiation source a selected distance, at least in one direction, to define a top wall and one or more side walls;

a first contact layer, the first contact layer being provided over at least part of the top wall of the phosphor layer.

36. (Amended) A light emitting device [according to claim 33,] comprising:

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a radiation source having a first contact region and a second contact region for providing radiation, said radiation source having a top surface and one or more side walls;

a phosphor layer provided adjacent to at least a portion of the one or more side walls of the radiation source, the phosphor layer including one or more excitable, light-emitting phosphors that produce a light emission when excited by the radiation;

a first contact layer for providing an electrical connection to the first contact region of the radiation source; and

wherein the first contact layer reflects UV radiation.

37. (Amended) A light emitting device [according to claim 33], comprising:

a radiation source having a first contact region and a second contact region for providing radiation, said radiation source having a top surface and one or more side walls;

a phosphor layer provided adjacent to at least a portion of the one or more side walls of the radiation source, the phosphor layer including one or more excitable, light-emitting phosphors that produce a light emission when excited by the radiation;

a first contact layer for providing an electrical connection to the first contact region of the radiation source; and

wherein the first contact layer reflects visible light.

42. (Amended) An array of visible light emitting devices according to claim 41, wherein selected radiation sources of the array of radiation sources have side walls that face adjacent radiation sources, said column contact layers extending adjacent at least a portion of [selected] said

side walls of the selected radiation sources to help reduce optical cross talk between the radiation sources.

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